CHARACTERISTICS OF A LARGE MULTI-CITY COLLECTION OF PEDESTRIAN COUNTS

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ABSTRACT

I assembled a large collection of turning movement counts with pedestrian data from across the United States and Canada, converted them to a uniform format, and estimated daily crossing volumes. Within each city and overall, pedestrian volumes are distributed lognormally by location, but the parameters of the distributions differ between cities and land use categories. Pedestrians and bicyclists cross the major street nearly as often as the minor. Intersections with more pedestrians also see more bicyclists, and intersections with moderate numbers of turning vehicles have the most pedestrian crossings. The “Walk Score” of locations is proportional to the log of the pedestrian volume, but overstates subjective evaluations. Locations of geotagged tweets from Twitter also have a predictable relationship to crossing volumes. Visual survey responses show a preference for locations with more pedestrians. Locations with many pedestrians have the slowest transit service.

Keywords: walkability, pedestrians, data

INTRODUCTION

The walkability metric that most of the public knows is Walk Score (*1*), a web service that ranks any location from 1 to 100 and rates it “car-dependent,” “somewhat walkable,” “very walkable,” or “walker’s paradise.” Walk Score deserves tremendous credit for making walkability a standard criterion in searches for housing, but has been criticized for making evaluations based only on distance, without knowledge of obstacles to walking (*2*). It is one of many projects (*3, 4, 5*) to predict pedestrian activity from land use data.

Pedestrian Level of Service (*6*) represents a different kind of walkability. It was originally conceived as a measure of how crowding limits freedom of movement (*7*), and has been augmented by delay at traffic signals (*8*), number and speed of turning vehicles (*9*), and a complicated combination of roadway characteristics (*10*). It makes no claims to predict pedestrian volume, only comfort.

A third perspective on walkability is quantitative urban design, exemplified by the Pedestrian Environmental Quality Index (*11*) and the Maryland Inventory of Urban Design Qualities (*12*). It focuses on proportions, materials, visibility, and activities of adjacent buildings and spaces. It is conceived as a measure of attractiveness, but treats presence of pedestrians as validation of the model’s success.

Is pedestrian volume direct evidence of walkability? If so, what volume is sufficient, and are different volumes necessary in different circumstances? What combination of population, employment, land use, roadway characteristics, architectural characteristics, and other necessities can achieve it, and how often do they?

Answering these questions is hampered by a lack of data about how much walking happens in different places. To help rectify this shortage I compiled tens of thousands of pedestrian counts from across the United States and Canada and examined their internal structure and how they relate to other external measures.

SOURCES OF PEDESTRIAN COUNTS

Pedestrian counts for this paper come from manual turning movement counts taken at intersections by city employees or transportation consultants. They record the number of people who entered each crosswalk of an intersection during some specified time period. Compared to screenline counts, intersection counts are more widely available, follow more uniform procedures, and reveal interactions between pedestrians and vehicles.

Toronto (*13*) and Montréal (*14*) offer convenient downloads of their full count data. Several other cities publish counts through Midwestern Software Solutions (Buffalo, NY (*15*), Minneapolis, MN (*16*), Phoenix, AZ (*17*), Virginia Beach, VA (*18*), Columbus, OH (*19*), and Washington, DC (*20*)) or Miovision (Cary, NC (*21*), Wenatchee, WA (*22*), and Auburn, ME (*23*)).

Others operate GIS portals with map interfaces (Vancouver, BC (*24*), Los Angeles, CA (*25*), Oakland, CA (*26*), Portland, OR (*27*), Vancouver, WA (*28*), and Bothell, WA (*29*)) or publish lists of PDF files (Washington, DC (*30*), Portland, OR (*31*), Corvallis, OR (*32*), Kansas City, MO (*33*), Richmond, VA (*34*), Cary, NC (*35*), High

Point, NC (*36*), McAllen, TX (*37*), Syracuse, NY (*38*), Binghamton, NY (*39*), Hilliard, OH (*40*), Richland County, OH (*41*), Atlanta, GA (*42*), and Chittenden County, VT (*43*)). The North Carolina (*44*), Minnesota (*45*), and Arkansas (*46*) Departments of Transportation also publish lists of files.

I have located many additional counts in planning documents through web searches for boilerplate text used on count forms ("Groups Printed," "Turning Movement Data," "Peak 15-Minute Interval Summary," "Manual Traffic Count Summary," "Total Vehicle Summary," and "Type of peak hour being reported").

EXTRACTING DATA FROM PDF FORMS

Except for the straightforward tables from Toronto and Montréal, online turning movement counts are PDF or HTML files. I wrote different converters to extract data from each variety of form. For PDF files, the Poppler utilities (*47*) have been invaluable. Poppler's "pdftotext" program extracts text from PDFs with basic layout preserved, while "pdftohtml" retains information about where on the page each chunk of text is drawn, and in what order, for forms with more complicated layouts.

It was too difficult to extract counts from most forms that lay out the numbers on intersection diagrams, because there is such variety to the diagrams. Forms laid out in straightforward rows and columns of numbers are more practical to work with.

I adapted Montréal's comma-separated-value file format (*48*) into an interchange format for comparing locations. Each record contains:

- A source file identifier
- The cross streets
- A record or group identifier
- The date and time being counted
- The 12 vehicle turning movements of a 4-way intersection, clockwise around the intersection beginning with southbound right turns
- Four pedestrian movements across intersection legs, clockwise from the north leg
- Four bicycle movements across intersection legs, clockwise from the north leg
- The latitude and longitude, if available

The format does not provide for intersections with more than four legs, bicycle turns, or detailed pedestrian characteristics like Los Angeles's separate counts of adults and children, but it is good enough. The compiled data files are available from my GitHub account (*49*).

ESTIMATING DAILY VOLUMES

Different intersections were counted at different times of day, most only during peak travel times. Almost all cover the PM peak, especially the 16:45-17:00 interval. Nearly as many cover the AM peak, but only half include the mid-day peak. A quarter cover the full daylight hours. Less than 1 percent continue all night, most of them in Minneapolis.

Because so many different times of day and summary periods (15 minutes, one hour, two hours) are represented at different intersections, it is useful to estimate a daily total for each intersection from whatever is available. To determine scaling factors, I began with the intersections where all daylight hours were counted. For each 15-minute period at each of these, I calculated the ratio of the pedestrian and vehicle counts from that period compared to the 16:45-17:00 baseline. I then weighted each intersection's scaling factors by its 16:45-17:00 counts to calculate an overall weighted average scaling factor for each 15-minute period.

The scaling factors are shown in Figure 1 and Table 1. A 15-minute count from any time of day can be divided by the scaling factor for that time to estimate the count for the 16:45-17:00 period, which can then be multiplied by the total area under the curve (52.2034 for pedestrians, 47.8191 for vehicles) to estimate the total daily count.

There is a much larger mid-day peak for pedestrians than for vehicles, and the AM peak begins, and the PM peak ends, half an hour later for pedestrians than for vehicles. The scaling factors roughly match the ones calculated by Zegeer et al (*50*) in 2005 for "fringe" areas, with their strong lunch peak and slightly lower morning and evening peaks, but those miss substantial evening walking by averaging it with low late-night volumes.

Because intersection volumes are often discussed in terms of peak hours rather than days, it is useful to know that the vehicular peak hour is 16:45-17:45, with 8.7% of daily vehicles and 7.7% of daily pedestrians.

LOGNORMAL DISTRIBUTION BY SITE

It is not uncommon to refer to the average pedestrian volume across several sites or to otherwise treat pedestrian counts as if they were distributed normally. For example, Moudon et al (*51*) refer to the average hourly pedestrians at urban and suburban sites near Seattle. Lindsey et al (*52*) refer to the average hourly pedestrians on roads of different classifications near Minneapolis. Harwood et al (*53*) refer to the mean daily pedestrian volume in Toronto, ON and Charlotte, NC. Ewing and Clemente (*12*) attempt to fit a bell curve to pedestrian counts by block in New York City.

Referring to the average is misleading because pedestrian counts always appear to be distributed lognormally by location, not normally. That is certainly the case in the counts for this paper, both in the complete sample and within each city, as Figure 2 illustrates. Ewing and Clemente's New York data also appears to be lognormal, judging from their skewed histogram. The descriptions of Harwood's and Lindsey's samples, with medians substantially lower than their means, suggest that they should also be on a log scale.

Instead of the mean and standard deviation, it is more meaningful to talk about the geometric mean of pedestrian counts (which should be nearly equal to their median) as the measure of the most common pedestrian experience, and the geometric standard deviation as the measure of how much they vary.

TYPICAL, COMFORTABLE, AND EXTREME PEDESTRIAN VOLUMES

In this collection, the geometric mean pedestrian volume at intersections, the center of the lognormal bell curve, is about 410 crossings per intersection per day, or 32 crossings during the PM peak hour, which can be regarded as some indication of the baseline North American pedestrian experience. (It is lower than the 700 daily crossings that Harwood et al (*53*) call “medium” in their pedestrian safety study of Toronto, ON and Charlotte, NC. Their sample is probably skewed high because Toronto has both more intersections and more pedestrians than Charlotte.)

At this frequency, crossing the street is not rare—someone crosses about every two minutes—and must not be tremendously difficult, yet anyone crossing is probably doing so alone, and signal cycles often go by without any pedestrians. I would call this situation “minimally walkable.” Given a typical walking speed of 4.2 feet per second (*54*), the next person who will cross is probably about 480 feet away, not quite out of sight, but not nearby. The space per person is well above the requirement for pedestrian crowding Level of Service A (*6*).

Where might a perception of “somewhat walkable” fall within the distribution? Richard Untermann and Anne Vernez Moudon (*55*) are among the few authors to have ever declared that some particular rate of pedestrian crossings is sufficient or insufficient, and they describe a street in Seattle with 150 pedestrians per street per hour, which is to say 300 per intersection, or 3900 per day, as “reasonably functional and safe” but “empty and unwelcome.” This rate is 1.06 geometric standard deviations above the geometric mean, so I will round it to 1 and say that an intersection above 3400 crossings per day is “somewhat walkable,” and, correspondingly, that one below 50 crossings per day is “somewhat unwalkable.” These two numbers also roughly correspond to Harwood’s “high” (3200) and “low” (50) percentiles.

Untermann and Moudon also refer to two streets that they do think offer a “healthy, solid pedestrian environment,” with 380 pedestrians per street per hour, or 760 per intersection, or 9880 per day. This is 1.5 geometric standard deviations above the geometric mean, so I will round it off and say that an intersection above 9900 pedestrians per day is “walkable” and one below 17 pedestrians per day is “unwalkable.” I share their perception that this volume is an important threshold, and will say more about why below in relation to turning vehicles.

At the same time, even though it is the lower bound for an acceptable level of activity, it is beginning to conflict with Pedestrian Level of Service standards. If the pedestrians are platooned by traffic signals, there must be at least 2 meters of clear walkway on each side of the street to stay within LOS A. The crowding metric for level of service is important for planning corridors and staircases that can’t be enlarged once built, but is in direct contradiction to the idea that the popularity of an intersection indicates how appealing it is as an environment.

At the extremes, the highest counts identified in the data are are a few downtown intersections in San Francisco and Toronto with an estimated 130,000 daily crossings, about 2.7 geometric standard deviations above the geometric mean. The lowest are intersections where only one pedestrian crossing was observed in a day. (Intersections that genuinely have no crossings can't be distinguished from ones where pedestrians were present but weren't being counted.)

TRENDS BY LAND USE AND CITY

What kinds of places are these that have 17, 50, 410, 3400, or 9900 pedestrian crossings per day? One way to characterize them is by checking what ranges of counts appear at intersections adjacent to different land use categories.

The counts for Kansas City, Oakland, Vancouver (WA), Vancouver (BC), Toronto, and Montréal were originally distributed with latitude and longitude location data, but other cities only provided street names. I geocoded as many counts as possible in Washington, DC, Minneapolis, Boston, and Los Angeles using the names of the intersecting streets and US Census Bureau TIGER shapefiles (*56*), for a total of about 10,000 geocoded count locations. Because they are concentrated in large cities, the geocoded locations tend to have higher daily pedestrian volumes than the overall collection, with a geometric mean of 1046.

Los Angeles (*57*) and Washington, DC (*58*) are the two of these cities that make land use shapefiles available to the public, so they are the two whose pedestrian volumes and land uses I could compare. In both cities, the lowest counts are in low density residential areas and the highest in central commercial areas, but there is quite a difference in the magnitudes of crossings within similar land use categories.

Washington's "Low Density Residential" land use category is roughly equivalent to Los Angeles's "Low Medium Residential," with single family houses and small apartment buildings, and both have a similar geometric mean of around 450-500 pedestrian crossings per day, exceeding the "minimally walkable" standard. But as density goes up, walking rates do not go up at the same rate in the two cities. Even 6-story apartment buildings in Los Angeles ("High Medium Residential") do not achieve the 1400 or so daily crossings that Washington's "Residential Moderate Density" rowhouses do, and Washington's "Commercial Low Density" intersections (neighborhood retail), which receive around 5200 daily crossings, outdo Los Angeles's highest "Regional Center Commercial" of around 3300.

The different pedestrian volumes associated with similar land uses in Washington and Los Angeles highlight how different cities can be. In spite of Los Angeles's low reputation for walkability and low numbers compared to Washington, its pedestrian numbers are moderately high for North American cities in general. Figure 2 shows the distribution of counts in selected cities, demonstrating that what is a fairly high pedestrian count in Burlington, VT would be fairly low in Vancouver and somewhere in the middle in Minneapolis. The especially low numbers from the North Carolina and Minnesota Departments of Transportation highlight how uncommon large pedestrian volumes are outside large cities.

VISUAL PREFERENCE SURVEY

I looked up pictures of the 10,000 geocoded locations with the Google Street View API (*59*) and conducted an online visual preference survey to find out whether the most attractive locations had the highest pedestrian counts. Each step of the survey presented a random picture from the set and asked, “Would you enjoy walking here? Yes / Maybe / No.”

The 250 respondents liked, disliked, and were neutral about locations all over the range of pedestrian volumes. Nevertheless, the geometric mean pedestrian count of “Yes” locations (1104/day) was 1.5 times that of “No” locations (732/day), and the “Maybe” locations (779/day) were in between. Aesthetics plays a role in walking behavior, but most walking still takes place in places that are not judged to be particularly attractive.

WALK SCORE

Walk Score (*1*) is well known as a measure of walkability, but the site does not describe in detail where the scores come from and what they signify. I queried the Walk Score site for the locations of the 10,000 geocoded pedestrian counts to find out what scores correspond to known pedestrian volumes, with the results shown in Figure 3.

There only seem to be 78 possible Walk Scores, not 100. For example, no location is ever given a score of 99 or 96. Each score corresponds to a predictable (but overlapping) range of pedestrian counts. The median daily count for each score s is approximately $e^{0.059s+2.56}$ ($R^2 = 0.277751$). This formula predicts a daily crossing volume of 4722 for a score of 100, which is typical of a moderately busy shopping street, not the highest pedestrian volume imaginable. A more complicated formula, $e^{2.52 \arcsin((s-47)/53)+5.42}$ ($R^2 = 0.358516$), gives more believable numbers for the highest scores, but the site still gives either a busy neighborhood street or a booming downtown a score of 100, with no way to distinguish between the two.

Perhaps because the top of the scale is too low, the subjective evaluations are too high. A score of 50 is typical of a fairly isolated single-family neighborhood, not really “somewhat walkable.” A score of 70 still falls short of rowhouse levels of activity, not really “very walkable.” The 90+ “walker’s paradise” is the only category where much walking actually takes place. It takes a 94 to get to what I have been calling “somewhat walkable” and between 99 and 100 to get to “walkable.”

GEOTAGGED TWEETS

Twitter has no inherent relationship to walkability, but the more time people spend on a street, the more chance there is that they will tweet from that street. Counting the number of tweets made available in 2013 through the Twitter Streaming API (*60*) within 300 feet of each intersection, filtered to remove duplicate locations and near-duplicates from the same person, does about as well as Walk Score ($R^2 = 0.355349$) at predicting pedestrian counts. Locations near major highways and rail lines, where many people who are posting to Twitter are riding instead of walking, are major exceptions. Figure 4 compares tweets and pedestrian volumes at the geotagged intersections. Because archives of Twitter are not widely available, I have calculated estimated crossing volumes for all United States intersections from TIGER and posted them to GitHub (*49*).

MAJOR AND MINOR STREETS

The available counts are skewed toward intersections with high vehicle volumes, with a geometric mean of around 25,000 vehicles per day. (The distribution is bimodal on a log scale, with another, smaller peak at 1400 vehicles per day.) This skew suggests that there is no inherent conflict between pedestrians and large numbers of through vehicles, as some of the intersections with the highest pedestrian counts also handle thousands of vehicles per hour.

What does limit walking is the common situation of one street carrying much more vehicle traffic than the other. In the available counts, 76% of vehicle movements into each intersection are from the major street and only 24% are from the minor. The through volume is even more polarized, with 85% of through vehicles entering from the major street. (Major and minor streets also have very different frequencies of turning: of vehicles entering from the major street, only 8.6% turn right and 8.1% turn left, while from the minor street, 27.8% turn right and 27.5% turn left.)

Pedestrian movements, however, are not very directional. Only 54% of pedestrian crossings are in the major vehicle direction and 46% are in the minor direction. The more traffic planning prioritizes the major direction, the more it delays pedestrians. The intersections where vehicle directions are evenly balanced tend to be crossed around 1495 times a day; the most directional, only 131.

Geometric mean pedestrian volumes are much higher (1660/day) at intersections of two one-way streets than at two two-way streets (414/day) or one of each (330/day), probably because one-way grids are concentrated in city centers.

TURNING VEHICLES

The major pedestrian-vehicle conflict is with turning vehicles. Every turn through a crosswalk takes time and space away from pedestrians, as Sarah Hubbard has shown (*61*, *62*), and every pedestrian in the crosswalk slows vehicles from turning.

The turning movement counts are too coarse to reveal individual conflicts between pedestrians and turning vehicles, but they do suggest how many of each can fit through the same space in the same time. Considering each hour rather than full days, both the hours with very few turning vehicles and the hours with large numbers of turning vehicles have low numbers of pedestrian crossings. The highest numbers of crossings happen in between, during hours with 396 vehicle turns, which, depending on the signal cycle length, means 1.5 to 3 vehicles turning through each crosswalk during each cycle. It appears that up to this point, turning vehicles are indicative of a place that is a destination in general, and probably in many cases are transporting people who then cross the street, while larger numbers of turns start to crowd out pedestrians.

My opinion is that interaction with turning vehicles is also what makes Untermann and Moudon's preferred volume of 760 intersection pedestrians per hour, and not much less than that, sufficient for walking comfort. The frequency is enough that at least one person is generally crossing in each direction in every crosswalk as part of every signal cycle. Because someone is crossing from the far side, drivers can see that the crosswalk is occupied and are less likely to make a turn into someone crossing from the near side, and because someone is also crossing from the near side, the crosswalk is fully occupied and drivers are unlikely to have the chance to turn in front of the pedestrian coming from the far side. Extrapolating from Figure 4 in Hubbard's study of right turns on green (*62*) suggests that slightly fewer pedestrians (600 per intersection, 7800 per day) might still be sufficient to eliminate turning vehicle interference with pedestrians.

BICYCLE VOLUMES

Of intersections where both pedestrians and bicyclists were counted, those with higher numbers of one also tend to have higher numbers of the other. For an intersection with daily pedestrian count p, the daily bicycle count is approximately $e^{0.681 \log p}$ ($R^2 = 0.168668$).

Bicycle counts are also lognormally distributed by location, with a geometric mean of 139 crossings per day and a geometric standard deviation of 4.387. The highest count is an estimated 9581 per day in Davis, CA, less than a tenth of the highest pedestrian or vehicle volumes.

As with pedestrians, only 53% of bicycle movements are along the major street. Much less data is available about bicycle turns, but they seem to be less common than vehicle turns: from the major street, 7.4% of bikes turn right and 4.9% left, and from the minor, 12.9% turn right and 14.4% left.

TRANSIT SPEEDS

Transit has a paradoxical relationship with walking. Walking to and from transit is an important generator of pedestrian activity (*63*), but at the same time, local transit service often acts as a "pedestrian accelerator" that replaces part of what would otherwise be a walking trip. Like any vehicles, buses and streetcars occupy intersection time, turn through the crosswalk, and encourage giving additional priority to the major street.

Through NextBus (*64*), the public has access to real time transit vehicle locations in many cities, including Toronto, Los Angeles, Washington, Boston, and Oakland. I calculated the average speeds of vehicles reported to pass within 100 feet of each geocoded intersection in these cities on Thursday, May 9, 2013, one of the most recent days for which data was available for all five.

Not surprisingly, the slowest speeds tend to be at the intersections with the most pedestrians. In all cities, pedestrian counts fall off as transit speeds increase, but in the cities other than Toronto, the base rate of walking is much lower, and there is a large cluster of outliers between 5 and 10 miles per hour. Figure 5 shows the relationships between speed and walking in Toronto ($R^2=0.173393$) and the other cities ($R^2=0.108339$).

CONCLUSION

All of the data presented in this paper was previously available in some form, but having it all in one place in a uniform format provides the first known opportunity to look at pedestrian behavior as a system rather than at individual locations in isolation. The major results are:

- There is more walking in the evening than standard scaling factors account for
- Pedestrian, bicycle, and vehicle counts should generally be compared between locations on a logarithmic rather than a linear scale
- In the absence of any other information, 32 intersection pedestrian crossings per hour and 11 bicycle crossings are the most likely rates to anticipate and plan for, but a small local survey will probably discover a higher or lower local median
- Because of the logarithmic scale, the busiest intersections will have many more crossings than the median, while the least busy will not have many fewer
- Pedestrians and bicyclists, unlike vehicles, need to cross major streets as frequently as they need to travel along them
- Walk Score has a predictable relationship with actual pedestrian volumes, and most locations with scores below 90 cannot reasonably be considered walkable
- The locations of geotagged tweets are also a reasonable predictor of pedestrian volumes

I hope the data and methods will be useful for additional research and that their availability will encourage other organizations that have been collecting but not releasing pedestrian counts to make their data public as well.

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TABLE 1 Pedestrian and vehicle scaling factors by time of day.

Pedestrian scaling factor						**Vehicle scaling factor**				
	:00	**:15**	**:30**	**:45**			**:00**	**:15**	**:30**	**:45**
00:00	0.1573	0.1494	0.1212	0.1041		**00:00**	0.1139	0.0990	0.0846	0.0769
01:00	0.0834	0.0831	0.0688	0.1036		**01:00**	0.0747	0.0685	0.0624	0.0550
02:00	0.1009	0.0616	0.0440	0.0361		**02:00**	0.0583	0.0517	0.0437	0.0385
03:00	0.0322	0.0292	0.0317	0.0234		**03:00**	0.0366	0.0353	0.0350	0.0348
04:00	0.0233	0.0225	0.0376	0.0631		**04:00**	0.0374	0.0483	0.0652	0.0793
05:00	0.0497	0.0650	0.1174	0.1849		**05:00**	0.0999	0.1433	0.2530	0.2779
06:00	0.1466	0.2034	0.2851	0.3493		**06:00**	0.2891	0.3914	0.5162	0.5973
07:00	0.4707	0.5222	0.6076	0.7308		**07:00**	0.6348	0.7576	0.8690	0.9210
08:00	0.6815	0.6628	0.7213	0.8251		**08:00**	0.8098	0.7680	0.7252	0.7094
09:00	0.7117	0.6555	0.7509	0.7136		**09:00**	0.6177	0.5964	0.5957	0.6030
10:00	0.6234	0.5783	0.6048	0.7114		**10:00**	0.5986	0.6019	0.5942	0.6156
11:00	0.7471	0.7407	0.8400	0.9472		**11:00**	0.6199	0.6471	0.6863	0.7169
12:00	1.0431	1.0785	1.1292	1.1038		**12:00**	0.7436	0.7366	0.7394	0.7520
13:00	0.9613	0.9078	0.8473	0.9328		**13:00**	0.7347	0.7209	0.7381	0.7403
14:00	0.9138	0.9053	0.8532	0.8289		**14:00**	0.7425	0.7534	0.7692	0.7771
15:00	0.8956	0.9549	0.9451	0.9739		**15:00**	0.8022	0.8282	0.8820	0.8726
16:00	0.9865	0.9748	1.0706	1.0000		**16:00**	0.9165	0.9319	0.9831	1.0000
17:00	1.0488	0.9800	0.9893	0.9664		**17:00**	1.0731	1.0753	1.0176	0.9390
18:00	0.9072	0.9038	0.8821	0.8099		**18:00**	0.8477	0.8222	0.7441	0.6754
19:00	0.7405	0.6696	0.6379	0.6335		**19:00**	0.6089	0.5911	0.5492	0.5124
20:00	0.6330	0.5376	0.4947	0.4639		**20:00**	0.4557	0.4350	0.4101	0.3839
21:00	0.4804	0.4883	0.4426	0.3626		**21:00**	0.3795	0.3430	0.3163	0.2758
22:00	0.3445	0.3220	0.3267	0.2768		**22:00**	0.2959	0.2806	0.2523	0.2169
23:00	0.2609	0.2478	0.2211	0.2007		**23:00**	0.2100	0.1847	0.1698	0.1339

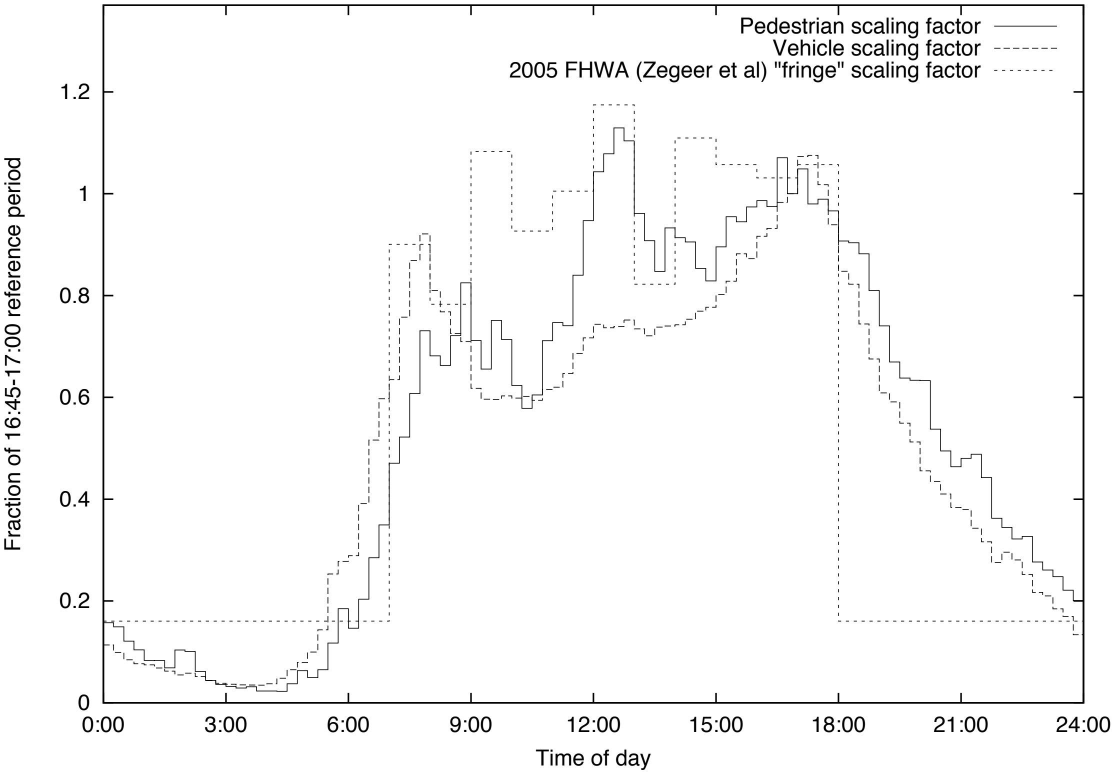

FIGURE 1 Vehicle and pedestrian scaling factors by time of day

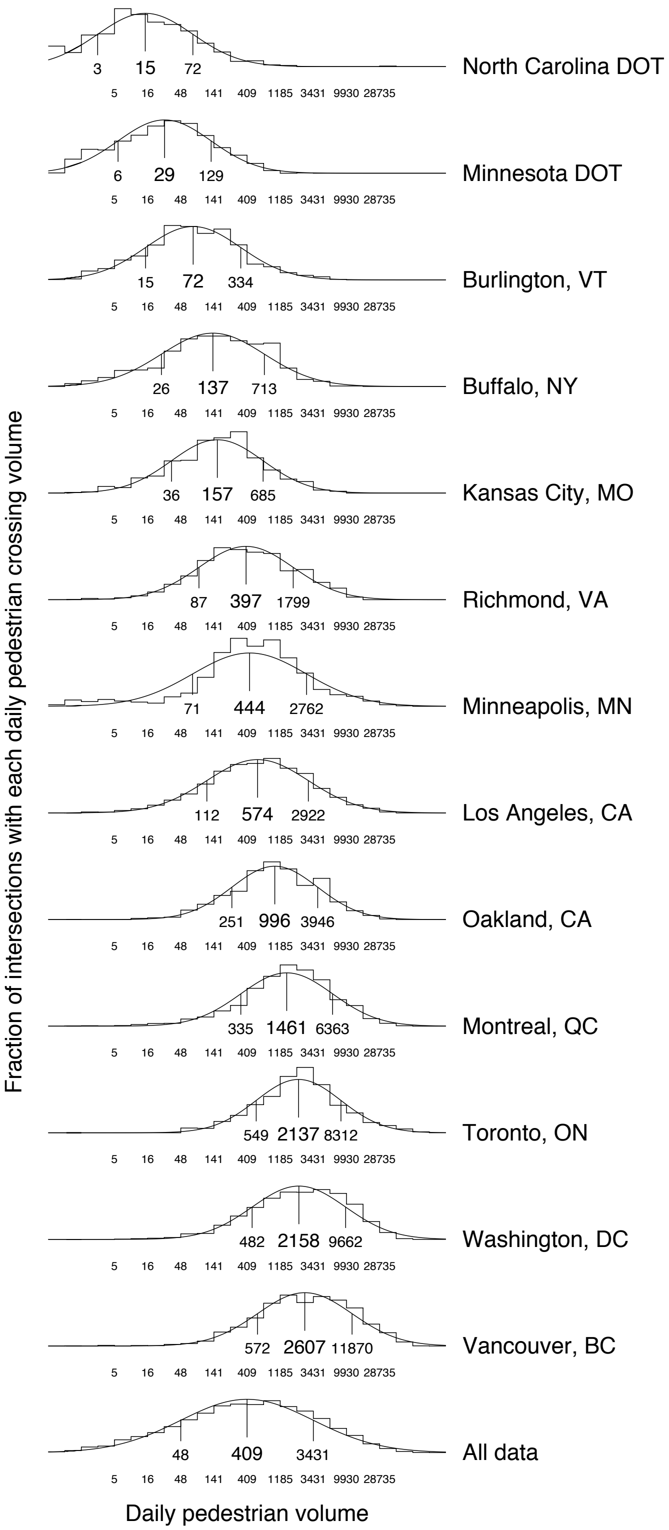

FIGURE 2 Distribution of daily pedestrian volumes within each city or state, with geometric mean and one geometric standard deviation above and below

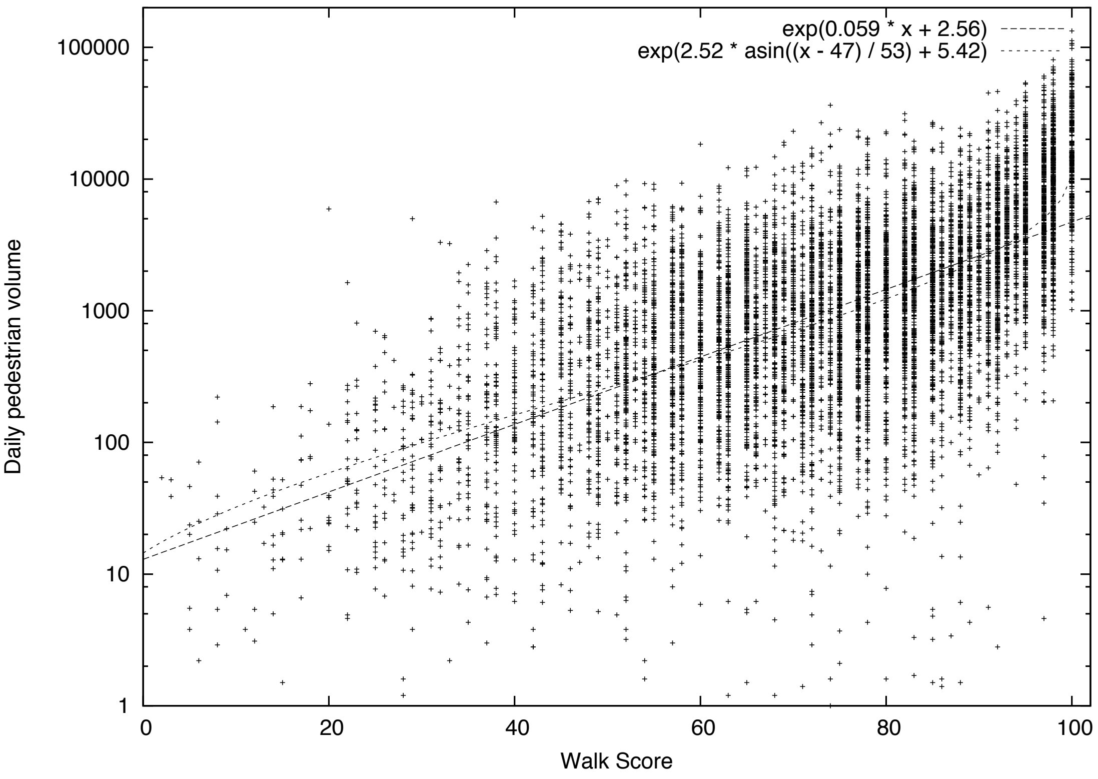

FIGURE 3 Daily pedestrian volumes associated with different Walk Scores

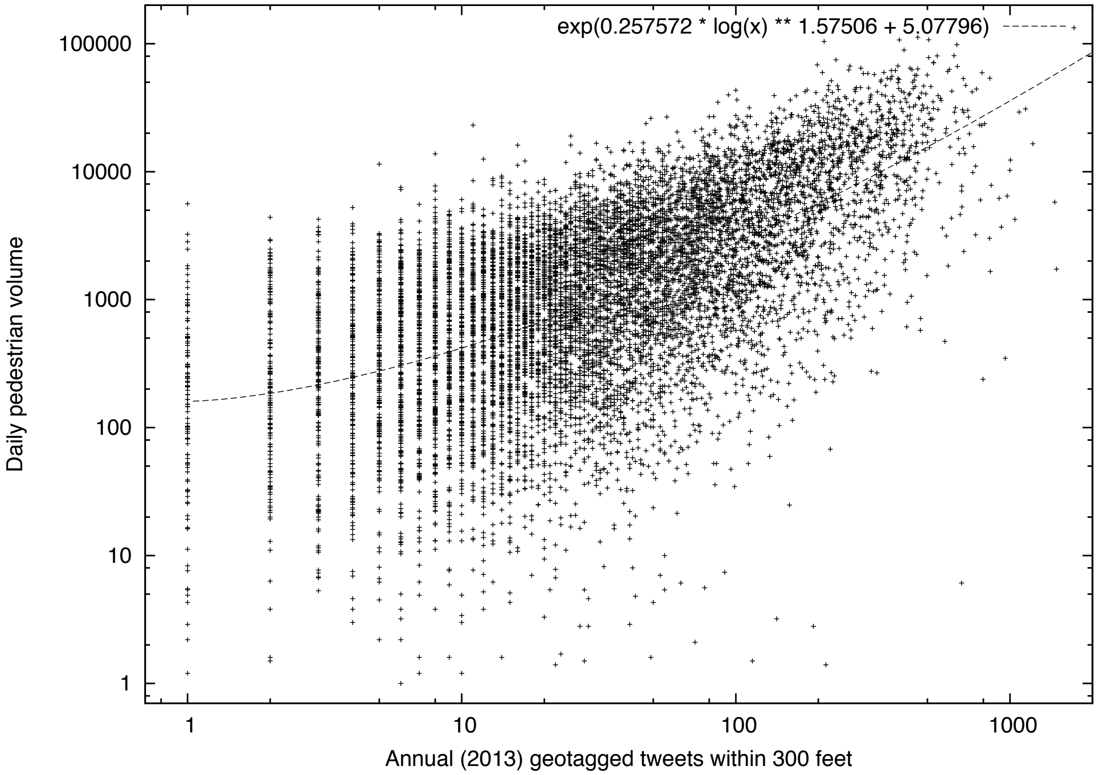

FIGURE 4 Daily pedestrian volumes associated with different nearby tweet counts

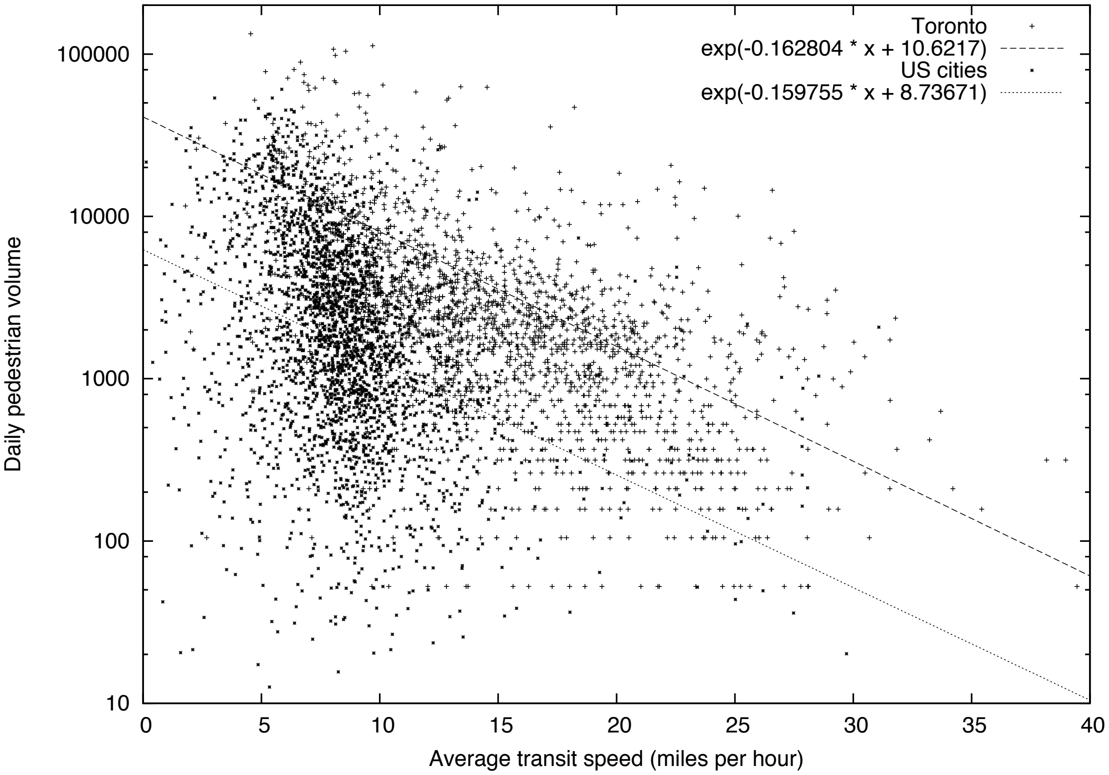

FIGURE 5 Daily pedestrian volumes associated with different transit speeds